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ABSTRACT

This document addresses physics programs in community college in 2001-2002. The data was gathered from a list of 1,785 community colleges. A survey was mailed to the various campuses as well as sent via email yielding to a 78% response rate. Physics programs in community colleges were often so small that 43% of departments that offered physics had only one physics faculty member. Furthermore, the number of physics sections that were offered by departments were limited because half of the campuses offered only three or fewer sections in physics. It should be mentioned that during the 2001-2001 academic years, the physics departments had at least one faculty retirements while only 5% of departments were recruiting new faculty. Some more specific findings about physics faculty are as follows: (1) 64% held full time appointments, mostly in tenured or permanent positions; (2) 39% of full time faculty and 36% of part time faculty has their PhD; and (3) the main difference between men and women faculty is the median number of years they had spent teaching at their current campus (8% for men and 5% for women) and the percentage with a PhD (41% for men and 26% for women). (MZ)

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Physics in the Two-Year Colleges: 2001-02

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Physics in the Two-Year Colleges: 2001-02

Highlights

- During the fall of 2001, there were 1,072 campuses offering a total of 5,105 sections of physics. There were 2,560 faculty teaching physics, and 102,000 students taking physics.
- The typical two-year college physics program was small. Forty-three percent of departments offering physics had only one physics faculty member, and five out of six had two or fewer full-time physics teachers.
- Similarly, the number of physics sections offered by each department was limited. Nearly half of the campuses offered three or fewer sections in physics.
- Physics offerings were primarily geared towards students planning to transfer to four-year schools. The majority of courses offered were algebra/trigonometry and calculus-based physics, equivalent to the introductory courses offered in four-year college and university physics departments. The largest two-year college programs were twice as likely as smaller departments to offer applied/technical physics and physics for education majors.
- Over the past two years, 13% of departments had at least one faculty retirement, 7% had at least one faculty member leave prior to retirement, and 2% had seen both. On the other side of the equation, 5% of departments were currently recruiting new faculty, 7% were planning to recruit the following year, and 1% were recruiting in both years.
- 64% of faculty held full-time appointments, nearly all in tenured or permanent positions. The remainder were part-time, with nearly all being temporary.
- Full-time faculty had taught at their current campus twice as long, and taught about twice as many sections, as part-timers. The percentage of all faculty that had a PhD was similar for full-timers (39%) and part-timers (36%). The percentage of women among faculty members was also almost identical for full-timers (15%) and part-timers (13%).
- The main difference between men and women faculty was the median number of years they had spent teaching at their current campus (8 for men vs. 5 for women) and the percentage with a PhD (41% of men vs. 26% of women).

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Introduction

For many years, the American Institute of Physics has been gathering information on physics education, but only recently have we filled in the last gap: two-year colleges. With 600,000 high school students enrolling immediately after graduation and another 500,000 enrolling within a few years after receiving their diploma, these institutions play a very important part in the post-secondary education pipeline. In 1996, a comprehensive survey was conducted, partially funded by the National Science Foundation's Advanced Technological Education Program, located in the Directorate for Education and Human Resources. This survey provided the first comprehensive look at who taught physics at the two-year college level, what kinds of courses were offered and how many students were enrolled, along with some additional information. Among the general outlines provided by the 1996 survey were that approximately 2,700 faculty members taught and 120,000 students took physics at two-year colleges.

The 2001 survey was undertaken to update and build upon some of the key findings from 1996. Starting with our list of 1,785 two-year college campuses from the earlier study, and taking into account both school closings and new openings, we ended up with a total of 1,773 campuses. We identified 1,072 (60%) that offered physics, up slightly from the 59% found in 1996. Each school was mailed a one-page questionnaire asking them to describe their physics courses and the faculty who were teaching physics during the fall term.

After hearing back from 840 (78%) and estimating for the non-respondents, we calculated that during the fall of 2001 there were approximately 5,105 two-year college sections of physics offered, 2,560 faculty teaching physics, and a total of 102,000 students taking physics. Faculty responses from the 1996 study indicated that roughly 15% of two-year college physics sections were offered anew each semester. Factoring this in, the present enrollment number is comparable to what we found five years ago. This suggests a stability in physics enrollments that more or less mirrors the picture for two-year college attendance in general. (2001 Digest of Education Statistics, Department of Education, NCES, T173, P207)

Characteristics of Physics Programs

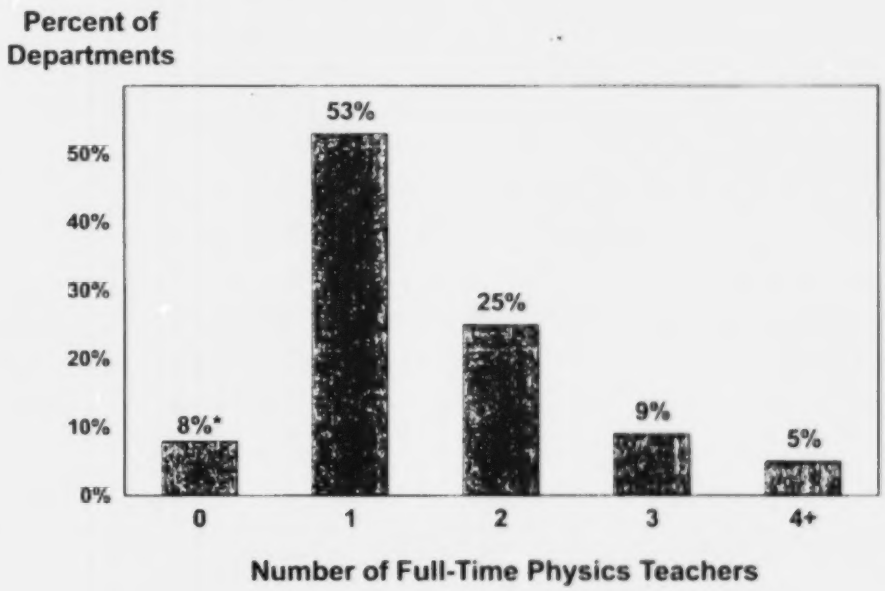
Most two-year college physics programs were small. Forty-three percent had only one physics teacher (38% with one full-time faculty member and 5% with only one part-timer) and as shown in **Figure 1**, five out of six departments had two or fewer full-time physics faculty. In

this respect, the potential for isolation is somewhat greater in physics than in chemistry, where 28% of teachers were the sole chemistry instructor on their campus. The distribution for part-time faculty is even more skewed, with 57% of departments having none and half of the remaining having only one part-timer.

The number of physics sections offered by departments was similarly limited. The mean number of sections taught was 4.9 with nearly half of the campuses offering three or fewer, while only 8% offered more than 10 **(see Figure 2)**. This compares with chemistry where the mean number of sections was 7.8, the median 6, and 30% of campuses offered three or fewer.

As shown in **Table 1**, the typical two-year college continued to gear its physics offerings to the transfer-oriented student, with the majority of courses offered being of the algebra/trig and calculus-based variety. One of the stated missions of two-year colleges may be to serve as a training ground for technicians, but as was found in the 1996 study, applied/technical physics was only taught at a small percentage of schools, and only made up 8% of all physics sections. Physics for education majors was even less common, with 13% of campuses offering the

Figure 1. Number of Full-Time Physics Teachers in Departments



*These departments have only part-time physics faculty.

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Figure 2. Number of Physics Sections Offered by Departments in Fall 2001 Term

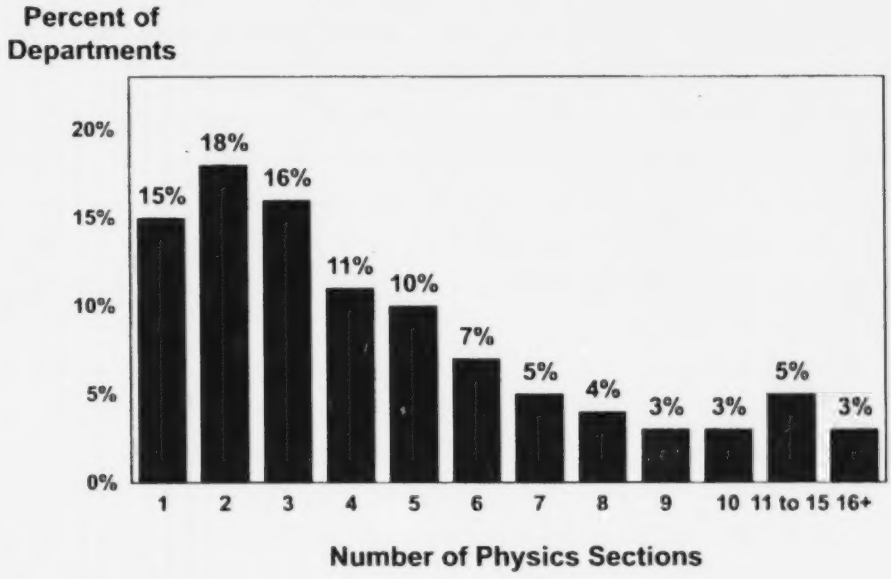

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Table 1. Types of Physics Courses Offered by Departments

Course Name	Campuses Offering This Course	% of All Physics Sections Offered
Algebra/Trigonometry	84%	35
Calculus-Based Physics	72	30
Conceptual Physics	30	11
Applied Physics/Technical Physics	21	8
Other Physical Science (at least half physics)	15	7
Physics or Physical Science for Education Majors	13	5
Other Physics	10	3

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course, making up only 5% of all physics offerings. The small size of most physics programs was likely one of the biggest impediments to a more diverse curriculum of physics courses. **Table 2** shows that schools offering 6 or more sections were twice as likely to offer conceptual, applied/technical, and physics for education majors.

Fifteen percent of physics programs had seen retirements among full-time permanent faculty during the past 2 years (see **Figure 3**), although in almost all cases (91%) it was just one person. Taking into account non-responding campuses, it is estimated that there were about 180 retirements nationwide from two-year college physics programs during this two year period. In addition, 9% of campuses had full-time faculty leave prior to retirement, which translates to about 100 nationwide. On the other side of the equation, 6% of departments were currently recruiting new faculty, which translates to about 70 open positions, and 8% reported plans to recruit in 2002, which would equal about 85 new hires nationwide. Given the roughly steady state of two-year college physics programs nationwide, the difference between departures and new hires is probably explained by internal recruiting and movement from part-time to full-time status.

Characteristics of Physics Faculty

Sixty-four percent of physics faculty were full-time and 36% were part-time, compared to 41% currently holding part-time appointments in chemistry and 34% in physics in 1996. **Table 3** shows some of the information on full-time and

Table 2. Types of Physics Courses Offered by Size of Physics Department

Course Name	Campuses Offering Fewer Than 6 Physics Sections (70%)	Campuses Offering 6 or More Physics Sections (30%)
Algebra/Trigonometry	79%	96%
Calculus-Based Physics	65	90
Conceptual Physics	23	48
Applied Physics/Technical Physics	17	31
Other Physical Science (at least half physics)	11	26
Physics or Physical Science for Education Majors	10	22
Other Physics	7	17

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Figure 3. Physics Program Recruitment and Retention

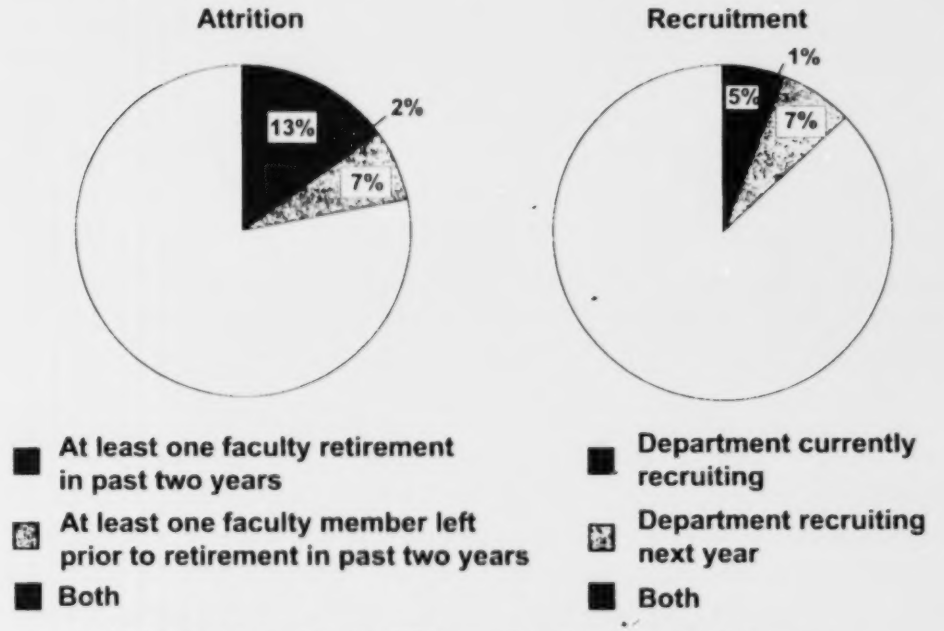

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Table 3. Characteristics of Full-Time and Part-Time Physics Faculty

	Full-Time (64%)	Part-Time (36%)
Mean Number of Sections Taught	2.4	1.3
Median Number of Sections Taught	2	1
% with PhD or EdD	39	36
% Tenured/Permanent	79	4
% Tenure-Track	17	1
% Temporary	4	95
Median Years Working at Campus	10	3
Mean Years Working at Campus	12.7	5.9
% Women	15	13

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part-time faculty provided by responding departments. Among full-time faculty, almost all were permanent, with 79% tenured and 17% tenure-track. Among part-timers, virtually all (95%) were temporary, with only 4% tenured and 1% tenure-track.

As was found in 1996, a nearly equal percentage of full-timers and part-timers held a PhD (39% and 36% respectively). The percentage was lower than for chemistry, where 54% of full-timers and 42% of part-timers held a PhD.

Figure 4 illustrates the number of years faculty had been teaching at their current school. Full-timers had taught at the same campus for a median of 10 years while part-timers had taught 3, about the same percentage as in chemistry, but down from 1996, when the median for full-timers was 13 and 4 for part-timers.

Figure 5 shows the number of physics sections taught by full- and part-time faculty. Over half of full-timers taught one or two sections, and the mean for all full-time faculty was 2.4. Three-fourths of part-timers taught only one section, with an overall mean of 1.3. These findings are similar to those found for physics in 1996. They are also similar to those in chemistry, where full-time chemistry teachers taught a mean of 2.7 chemistry

Figure 4. Number of Years Teaching at Current School

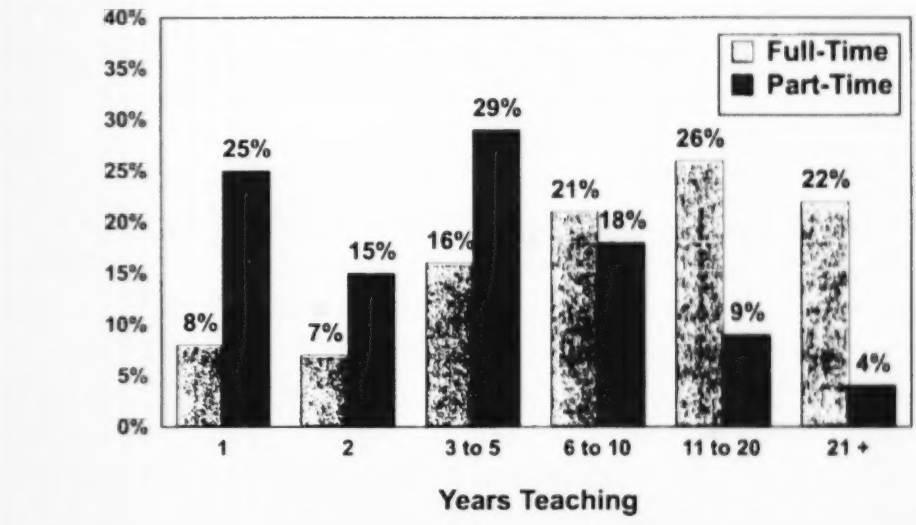

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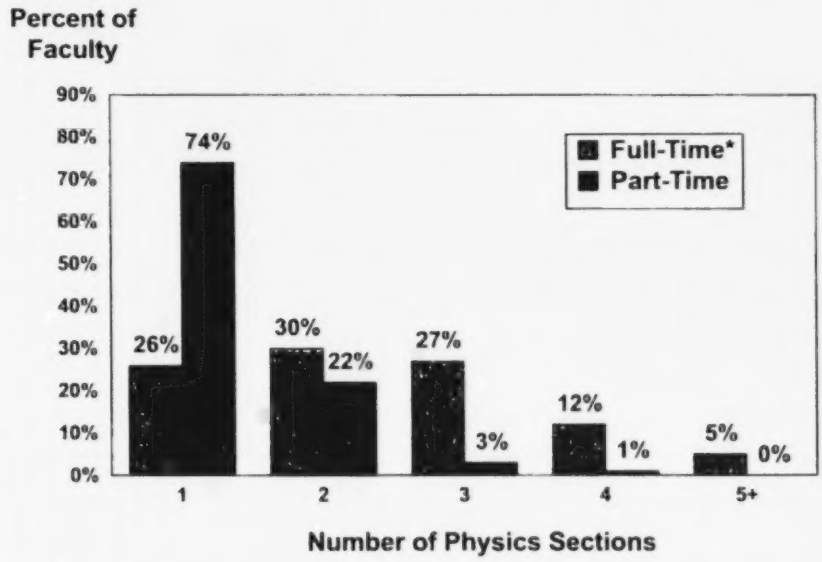
Figure 5. Number of Physics Sections Taught by Faculty



*some full-time faculty also teach courses in other disciplines or have administrative responsibilities

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sections and part-timers taught a mean of 1.3.

Women made up only 14% of physics teachers, although this was up from 11% in 1996. In contrast, 32% of chemistry faculty in 2001 were women. The seemingly low percentage in physics is not all that surprising, considering the fact that women make up only 15% of physics graduate degree holders. **Table 4** compares characteristics of physics faculty by gender. As was true in 1996, there were no significant differences in teaching load or full-time/part-time status between men and women. Forty-one percent of men held a PhD compared to 26% of women, and this disparity held true even when controlling for years of experience at their institution. Once again, this difference can likely be explained by the differing academic outcomes of women and men. When looking at recent graduate level physics degree recipients, 65% of men earned a PhD and 35% earned a Master's, while the comparable figures for women were 54% and 46% respectively. (Mulvey and Nicholson, 1999-2003)

Table 4. Characteristics of Women and Men Physics Faculty

	Women (14%)	Men (86%)
% Full-Time	69	67
Mean Number of Sections Taught	2.2	2.0
Median Number of Sections Taught	2	2
% with PhD or EdD	26	41
% Tenured/Permanent	53	57
% Tenure-Track	16	11
% Temporary	31	32
Median Years Working at Campus	5	8
Mean Years Working at Campus	7.9	11

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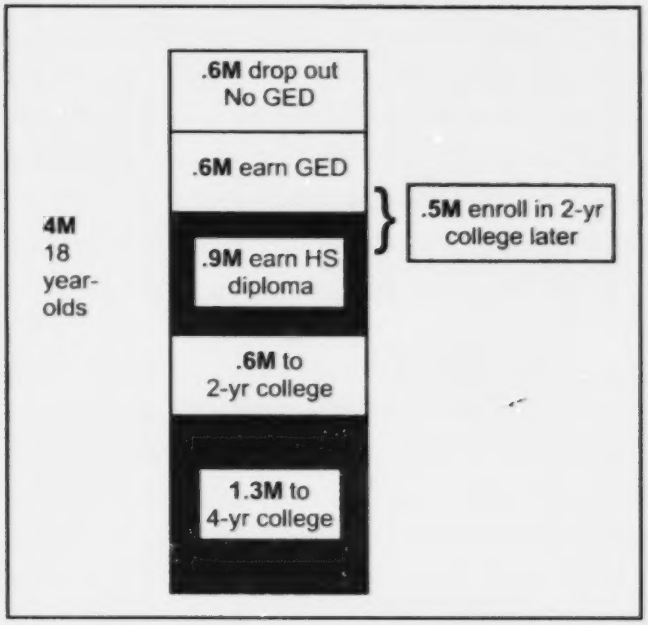
The Future of Two-Year College Physics

Figure 6 shows the immediate high school outcomes of 18 year-olds in the late 1990's. Nearly as many students are enrolled in two-year colleges as four-year colleges in a given year, and although the typical two-year college physics department is small, when added up the approximately 119,000 students who take physics in a given year at these schools account for about 25% of the total number of students taking introductory level physics nationwide (Mulvey and Nicholson, 2002). Clearly, two-year colleges are a major part of both the education pipeline in general and specifically in physics.

Unlike four-year colleges, where the typical student is aiming for a bachelor's degree, two-year college students' goals vary. As noted earlier, physics departments appear to be serving transfer-oriented students very well, with the majority of courses offered being similar to those offered at the four-year college level. The challenge is to reach enrollees who do not have the goal of transferring in mind, of which there are many, including those looking for vocational training and career advancement certification. Still others enroll in two-year college classes without matriculating into a specific accredited program, rather seeking an informal upgrading of skills, or simply pursuing an individual interest.

Figure 6. Immediate High School Outcomes for Students in the Late 1990s



Sources: U.S. Department of Education - NCES, Digest of Education Statistics, 2001, T103, 182; NCES, National Education Longitudinal Study, Third Follow-Up, 1994:Unpublished Data; American Council on Education, The American Freshman, 1999:15

These populations reflect a unique function that two-year schools fulfill in our society, and most of the schools probably have a sizeable population of students with these goals. This makes it all the more surprising that four-fifths of the two-year campuses' physics programs offered no applied/technical courses and two-thirds offered no conceptual courses. In addition, on the 40% of campuses where no physics classes at all are offered, non-traditional courses would probably be especially well-suited, aiming to serve the high percentage of students who are not looking to transfer. Unfortunately, with the current small size and low visibility of most departments, and the budgetary crises that many state and local governments are currently facing, the expansion of physics programs at two-year colleges may not be feasible in many areas at the current time.

Methodology

Starting from the list of 1,785 two-year college campuses assembled as part of the 1996 sample, we found that by the fall of 2001, 93 campuses had closed or merged. We also found 81 newly-opened campuses listed in the US Department of Education's Integrated Postsecondary Education Data System (IPEDS), for a total updated population of 1,773

campuses. We located 1,072 (60%) that offered physics, up slightly from the 59% found in 1996.

Each campus was mailed a one-page questionnaire asking them to describe their physics courses and the faculty who were teaching physics that term. Non-respondents to the mailed questionnaire were electronically sent an online version of the survey. Ultimately, we heard from 840 (78%) campuses directly. In addition, we gathered information on another 164 from their websites, providing us with full or partial data for nearly 94% of the population.

Though the profile of schools that were direct respondents was similar to that for the schools where information was culled from websites, analysis in this report is, unless otherwise noted, based on the former group only. As part of the current round of the project, we also surveyed two-year college chemistry departments on behalf of the American Chemical Society, and comparisons between the two fields have been made wherever appropriate.

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